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(54) **Ear-protection cup for ear muffs or headphones.**

(57) An ear-protection cup (1) for ear muffs or headphones comprising a cup-shaped frame and a resilient sealing member (5) located at the peripheral edge (4) thereof, by means of which the ear-protection cup (1) can be brought into abutment with an annular shaped part of a user's head located around the ear. The frame is composed of a rigid, cup-shaped outer shell (2) and an inner wall (6, 7) spaced from the outer shell (2) and extending for a substantial way between the inner parts of the outer shell (2) to which it is rigidly connected. The inner wall (6, 7) thus defines between itself and the outer shell (2) an intermediate space (12) in which a layer (13) of elastomeric material is arranged compressed between the outer shell (2) and the inner wall (6).

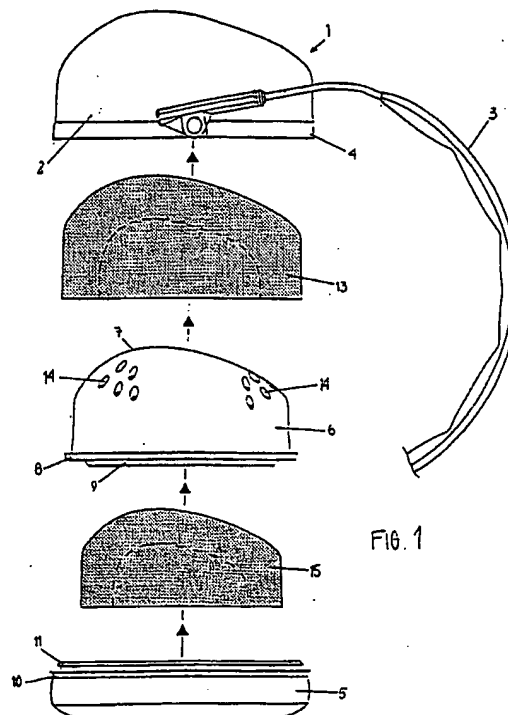


FIG. 1

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The present invention relates to an ear-protection cup for ear muffs or headphones, such as known through U.S. Patent No. 2,684,067, comprising a cup-shaped frame and a resilient sealing member located at the peripheral edge of the frame, for bringing the cup into abutment with an annular shaped part of a user's head located around the ear, the frame being composed of a rigid, cup-shaped outer shell and an inner wall spaced from the outer shell and extending for a substantial way between the inner parts of the outer shell and defining an intermediate space between its main part and the outer shell.

While ear-protection devices known in the art such as the one described above substantially reduce external noise, such reduction is incomplete and, therefore, should be improved.

The object of the invention is to provide an ear-protection cup of the type described above which gives improved dampening of disturbing external noise with relatively high frequency, e.g. about 2000 Hz or more, in comparison with previously known ear-protection cups of similar type.

This is achieved according to the invention by an ear-protection cup described in the introduction substantially in that the inner wall is rigidly connected to the inner parts of the outer shell and a layer of elastomeric material is arranged between the outer shell and the inner wall, which exert pressure on it.

Thanks to the construction of the frame, external noise that may give rise to a wave pattern and, consequently, vibration in the outer shell will be dampened considerably more efficiently than would be the case, if the frame consisted in known manner of a single shell. The reason for this seems to be that the two shells which, since they have different dimensions and therefore different oscillatory patterns, will vibrate differently, the oscillatory movements thereby interfering with each other and being dampened mechanically by the intermediate layer of compressed elastomeric material. The outer shell thus has greatly reduced freedom to perform oscillatory movements and will therefore exert a higher reflective influence on the sound coming from outside. Furthermore, part of the sound will be converted to heat in the elastomeric material which acts on the whole as a sound trap since the sound entering has further to travel in this material during its passage towards the perforations in the inner shell.

In this case the inner shell may be provided with stiffening flanges in order to achieve an enhanced difference in oscillatory pattern (frequency characteristic) between the two shells.

According to another embodiment of the invention the inner shell is provided with a number of through-openings arranged therein.

According to a preferred embodiment of the invention the intermediate gap between the outer and inner shells, filled with the elastomeric material, has

a depth of 1-3 mm.

The layer of elastomeric material is suitably compressed to less than half, preferably to less than one quarter of its thickness in unloaded state in order to achieve strong mechanical suppression of the oscillatory motion in the two shells.

In order to achieve direct acoustic communication between the space between the two shells and the space within the inner shell, the inner shell is provided with sound passages as mentioned previously, e.g. in the form of through-openings which may advantageously consist of perforations. Such an embodiment of the ear-protection cup increases its ability to achieve good suppression of even low-frequency sound despite the reduced free space inside the outer shell caused by the presence of the inner shell.

According to yet another embodiment of the invention the inner wall consists of a substantially flat wall extending between the inner sides of the outer shell, said inner wall attached to the outer shell by means of spacers and being suitably arranged to carry a headphone.

The invention will be described in more detail in the following with reference to a number of embodiments shown by way of example in the drawings in which

Figure 1 shows an exploded view of one cup of an ear muff in a first embodiment,

Figure 2 shows an ear muff arrangement, the cup according to Figure 1 being shown in section, and Figure 3 shows a section through a cup with headphone according to another embodiment of the invention.

One ear-protection cup of an ear muff arranged is generally designed 1 in the drawings.

The cup 1 comprises a substantially cup-shaped, rigid outer shell 2 for suitable plastic material, for instance. The cup 1 is flexibly attached in conventional manner to the end of a headband 3 and is provided at its peripheral edge 4 with a resilient sealing ring 5 intended to be in contact with the wearer's head.

In the embodiment illustrated in Figures 1 and 2 the cup 1 comprises a cup-shaped rigid inner wall in the form of a hollow body 6. The outer part 7 of the body 6, facing the hollow body 6. The outer part 7 of the body 6, facing the outer shell 2, has suitably the same external contour as the internal contour of the outer shell 2.

The opposite, open end of the cup 6 is provided with a peripheral flange 8 protruding therefrom, and an annular shoulder 9 by means of which, when the cup is inserted into the outer shell, it is clamped between the latter and the outer sealing ring 5 which is provided with corresponding peripheral protrusions 10, 11.

When the cup 6 is inserted into the outer shell 2, therefore, a gap 12 is formed in which an insert 13 of elastomeric material shall be arranged so that said

insert 13, when applied, fills out the space 12 under compression from the outer shell 2 and the inner wall 6. In the embodiment shown here the gap between the outer shell and inner wall is only a few millimetres wide, e.g. 1-3 mm.

The elastomeric material used for the insert 13 should be compressible to more than half and preferably more than one quarter of its thickness in unloaded state. Certain foam plastics and the like are suitable for the elastomeric material.

The cup 6 illustrated is suitably provided with a number of through-openings 14.

The interior of the cup 6 may suitably be provided with a dampening filler material 15 of suitable cellular structure.

The insert 13 of elastomeric material compressed between the outer shell 2 and the cup 6 functions as a sound trap and creates a considerably longer path for the sound from the outer shell to travel through the elastomeric material to the perforations in the inner shell. A part of this sound will also be converted to heat in the elastomeric material.

Figure 3 shows a second embodiment of the invention in which, instead of the body 6 illustrated in Figures 1 and 2, a substantially flat plate forms the inner wall. This may suitably also carry a head phone 16. The plate 6 may be attached to the outer shell 2 by means of spacers 17. An insert 13 of elastomeric material is similarly arranged in the space between the plate 6 and the outer shell 2 and is compressed between the outer shell 2 and the plate 6. Instead of the through-openings in the cup 6 shown in Figures 1 and 2, a sound passage is formed in this embodiment through gaps between the ends of the plate 6 and the outer shell.

The invention can of course be varied in many ways within the scope of the following claims. The desired sound passage between the two spaces in the ear-protection cup separated by the inner wall be effected in many other ways besides by means of the openings in the cup 6 shown in Figures 1 and 2 and the gaps between the ends of the plate 6 and the outer shell (Figure 3), in order to achieve a suitable sound passage.

Claims

1. An ear-protection cup for ear muffs or headphones, comprising a cup-shaped frame and a resilient sealing member (5) located at the peripheral edge (4) thereof, by means of which the ear-protection cup (1) can be brought into abutment with an annular shaped part of a user's head located around the ear, and wherein the frame is composed of a rigid, cup-shaped outer shell (2) and an inner wall (6, 7) spaced from the outer shell (2), said inner wall defining between

the main part thereof and the outer shell (2) an intermediate space (12), **characterized** in that the inner wall (6) is rigidly connected to the inner parts of the outer shell (2) and a layer (13) of elastomeric material is arranged between the outer shell (2) and the inner wall (6) under pressure exerted by said outer shell (2) and said inner wall (6) on said layer of elastomeric material (13).

2. An ear-protection cup as claimed in claim 1, **characterized** in that the inner wall (6) is provided with stiffening flanges.
3. An ear-protection cup as claimed in claims 1-2, **characterized** in that the inner wall (6) is provided with a number of through-openings (14) arranged therein.
4. An ear-protection cup as claimed in claim 3, **characterized** in that said openings (14) at least partially consist of perforations in the inner part of the inner wall (6).
5. An ear-protection cup as claimed in claims 1-4, **characterized** in that the intermediate space (12) has a depth of 1-3 mm.
6. An ear-protection cup as claimed in claims 1-5, **characterized** in that said layer (13) of elastomeric material is compressed to less than half, preferably to less than one quarter of its thickness in an unloaded state.
7. An ear-protection cup as claimed in claim 1, **characterized** in that the inner wall (6) consists of a substantially flat wall extending between the inner sides of the outer shell (2).
8. An ear-protection cup as claimed in claim 6, **characterized** in that said inner wall (6) is spot-wise attached to the outer shell (2) by means of spacers (17).
9. An ear-protection cup as claimed in claims 7-8, **characterized** in that said inner wall (6) is arranged to support a headphone (16).

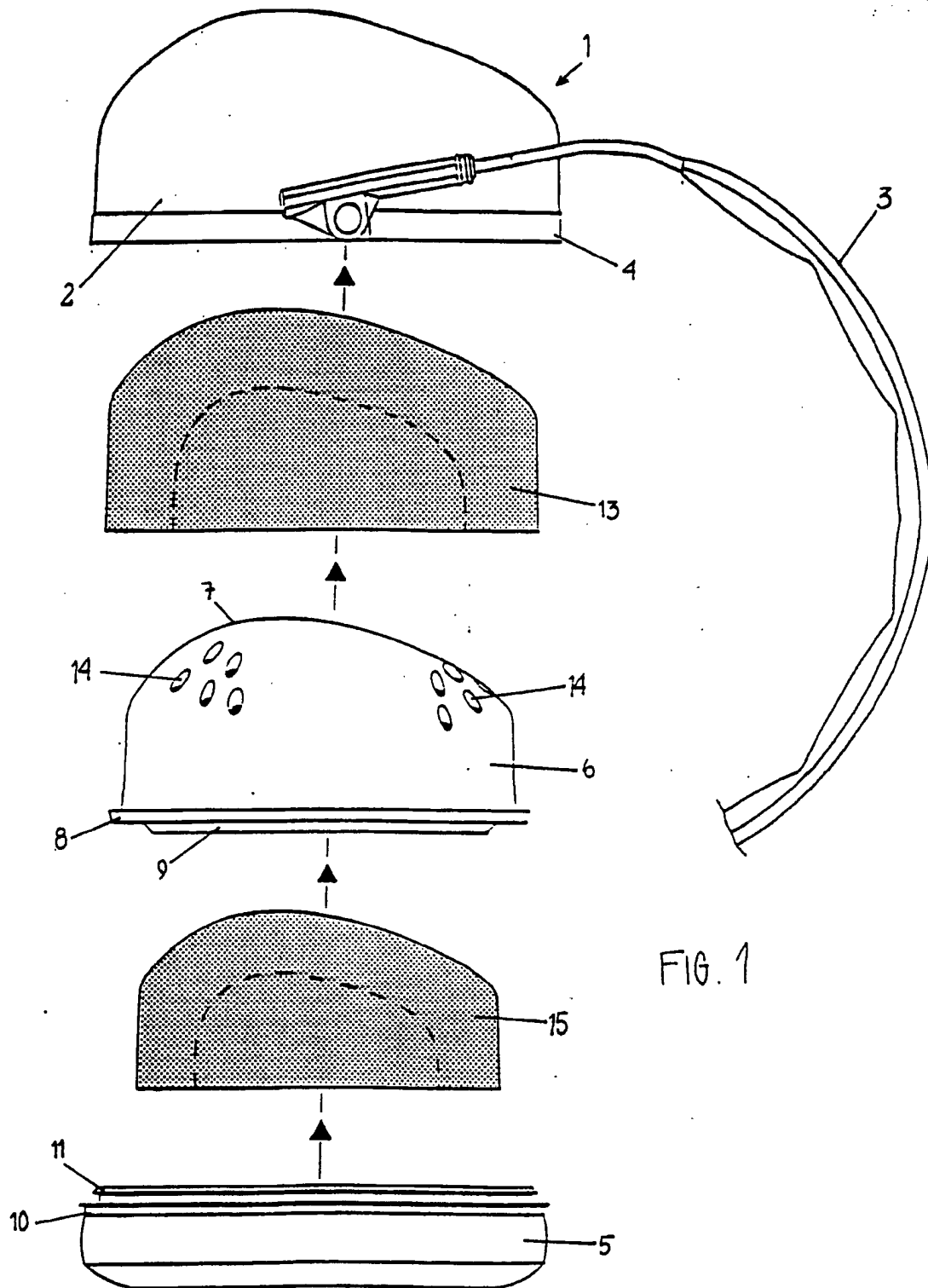


FIG. 1

FIG. 2

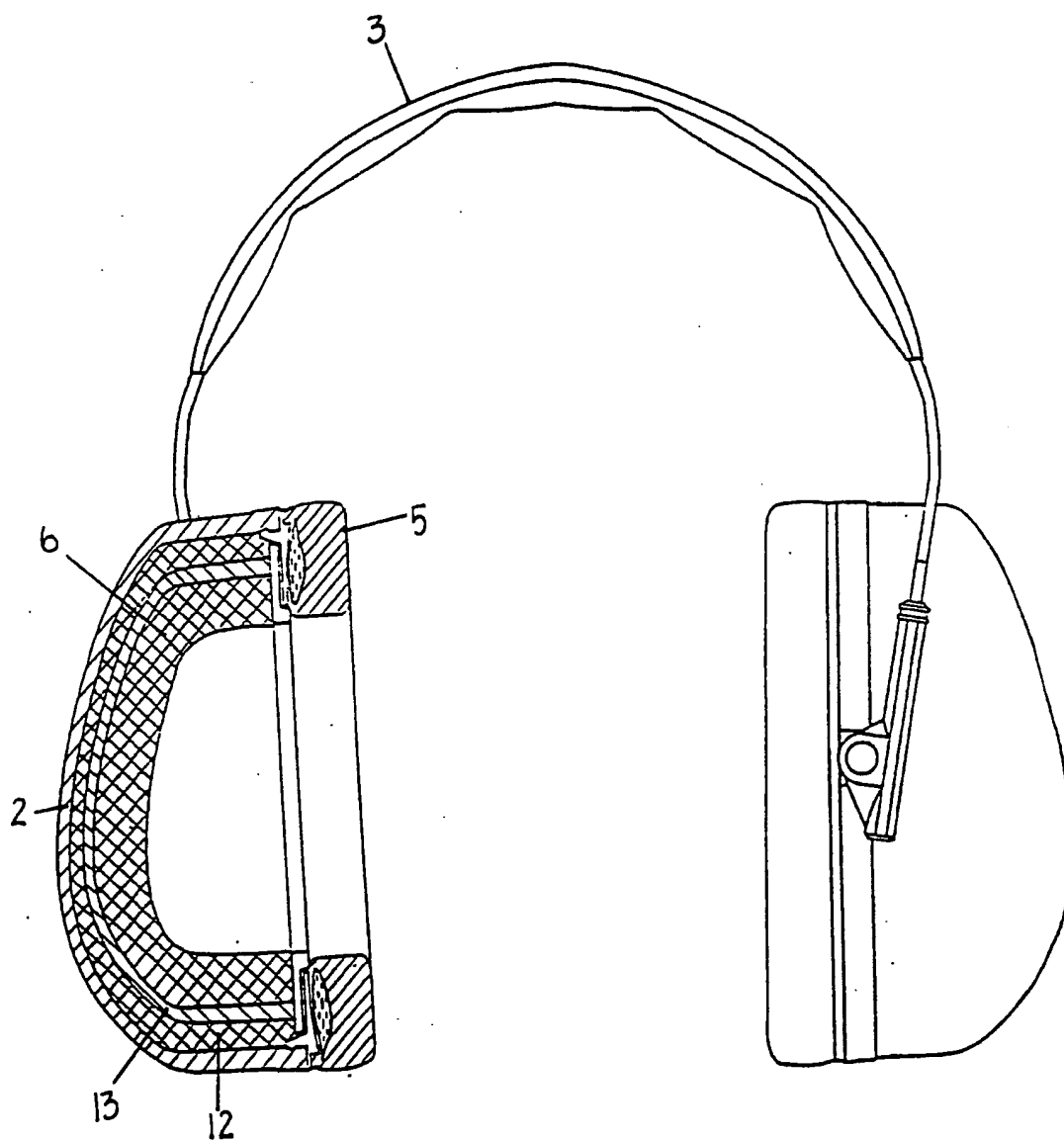
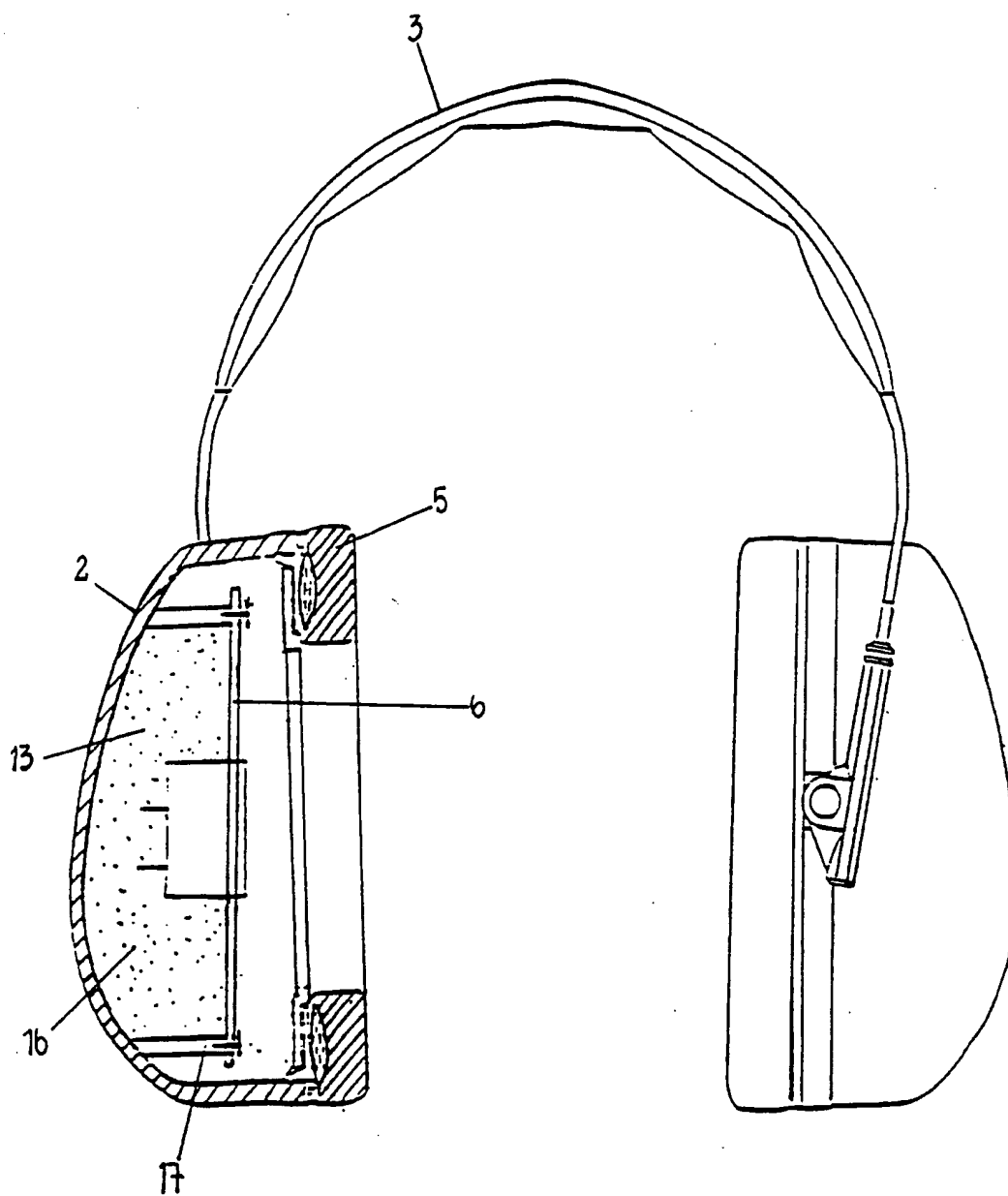


FIG. 3





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 85 0262

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	US-A-2 902 692 (CHRISTY) * column 2, line 61 - line 71 * * column 3, line 42 - column 4, line 2; figure 11 *	1,2	A61F11/14 A42B3/16 H04R1/10
Y	EP-A-0 338 463 (GENTEX)	1,2	
A	* column 4, line 20 - line 32; figure 2 *	6,9	
A	US-A-4 437 538 (OHLSSON) * column 1, line 38 - line 46; claim 5; figures *	1,3,4,7	
A,D	US-A-2 684 067 (LIENARD) * column 2, line 25 - line 44 * * column 4, line 70 - column 5, line 7; figure 1 *	1,2,9	
A	US-A-4 037 273 (LABAIRE) * column 4, line 15 - line 31; figure 3 *	1	
A	GB-A-598 030 (COBBE)		TECHNICAL FIELDS SEARCHED (Int. Cl.5) A61F A42B H04R
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 17 JANUARY 1992	Examiner KLEIN C.
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